

CLAIMS

What is claimed is:

1. A Schottky device comprising:
a substrate layer of a first conductivity type having a surface;
a guard ring structure overlying the surface of the substrate layer and surrounding a barrier region of the substrate layer, the guard ring structure comprising a gate of a second conductivity type disposed over a gate dielectric; and
a metal overlying the barrier region, the metal and the barrier region forming a Schottky junction.
2. The Schottky device of claim 1, the metal comprising a silicide layer that includes a first portion and a second portion, the first portion of the silicide layer overlying the barrier region and a second portion of the silicide layer contacting the gate.
3. The Schottky device of claim 2, further comprising an isolation region formed in the substrate layer, the isolation region defining a moat region in the substrate layer, the moat region including the barrier region.
4. The Schottky device of claim 3, the gate extending over at least a portion of the isolation region.
5. The Schottky device of claim 4, the gate comprising a top surface, an inner side surface and an outer side surface, the second portion of the silicide layer extending substantially over the top surface and the inner side surface.
6. The Schottky device of claim 5, the inner side surface having a substantially undulating shape.
7. The Schottky device of claim 6, the substrate layer being doped with an n-type dopant and the gate being doped with a p-type dopant.

8. The Schottky device of claim 1, further comprising a depletion region that extends under the gate dielectric and the barrier region.

9. The Schottky device of claim 2, further comprising at least one contact contacting the second portion of the silicide layer extending over the top surface of the gate.

10. The Schottky device of claim 2, the gate comprising a top surface, an inner side surface and an outer side surface, the first portion of the silicide layer extending substantially over the top surface, the inner side surface being substantially free of the silicide layer.

11. The Schottky device of claim 10, further comprising a first contact contacting the second portion of the silicide layer extending over the top surface of the gate and a second contact contacting the first portion of the silicided layer extending over the barrier region.

12. The Schottky device of claim 1, the gate comprising a first conductive layer and a second conductive layer, the second conductive layer being narrower than the first conductive layer and being aligned over the first conductive layer.

13. A Schottky device comprising:
a guard ring structure disposed over a substrate layer of a first conductivity type, the guard ring structure surrounding a barrier region of the substrate layer, the guard ring structure including a gate of a second conductivity type disposed over a gate dielectric layer; and

a silicide layer including a first portion overlying the barrier region to form a Schottky junction and a second portion contacting the gate.

14. The Schottky device of claim 13, further comprising an isolation region formed in the substrate layer, the isolation region defining a moat region in the substrate layer, the moat region including the barrier region.

15. The Schottky device of claim 14, the gate comprising a top surface, an inner side surface, and an outer side surface, the first portion of the silicide layer extending substantially over a top surface and the inner side surface.

16. The Schottky device of claim 15, the inner side surface of the gate having a substantially undulating shape.

17. The Schottky device of claim 13, the gate comprising a top surface, an inner side surface and an outer side surface, the first portion of the silicide layer extending substantially over the top surface, the inner side surface being substantially free of the silicide layer.

18. The Schottky device of claim 17, further comprising a first contact contacting the second portion of the silicide layer extending over the top surface of the gate and a second contact contacting the first portion of the silicided layer extending over the barrier region.

19. The Schottky device of claim 13, the gate comprising a first conductive layer and a second conductive layer, the second conductive layer being narrower than the first conductive layer and being aligned over the first conductive layer.

20. A method of fabricating a Schottky device, the method comprising:
providing a substrate layer of a first conductivity type having a surface;
forming a guard ring structure on the substrate layer, the guard ring structure defining a barrier region in the substrate layer, the guard ring structure including a gate of a second conductivity type disposed over a gate dielectric; and

forming a metal overlying the barrier region to provide a Schottky junction.

21. The method of claim 20, the metal comprising a silicide layer that includes a first portion and a second portion, the first portion of the silicide layer overlying the barrier region and a second portion of the silicide layer contacting the gate.

22. The method of claim 21, the gate comprising a top surface, an inner side surface and an outer side surface, the second portion of the silicide layer extending substantially over the top surface and the inner side surface.

23. The method of claim 22, further comprising providing the inner side surface of the gate with a substantially undulating shape.

24. The method of claim 20, the guard ring structure being formed by forming the gate dielectric layer over the substrate layer and then forming the gate over the gate dielectric layer.

25. The method of claim 24, further comprising forming a second gate over the gate disposed over the gate dielectric layer, the second gate being substantially narrower than the first gate and forming a stepped-shape gate structure with the first gate.

26. The method of claim 21, forming at least one contact contacting the second portion of the silicide layer extending over the top surface of the gate.

27. The method of claim 21, the gate comprising a top surface, an inner side surface and an outer side surface, the first portion of the silicide layer extending substantially over the top surface, the inner side surface being substantially free of the silicide layer.

28. The method of claim 27, further comprising further comprising forming a first contact contacting the second portion of the silicide layer extending over the top surface of the gate and a second contact contacting the first portion of the silicided layer extending over the barrier region.

29. A method of mitigating perimeter edge effects of a Schottky diode, the method comprising:

5 providing a Schottky diode that includes a Schottky barrier metal overlying a substrate layer of a first conductivity type, forming a guard ring structure on the substrate layer that substantially surrounds the Schottky diode, the guard ring structure including a gate of a second conductivity type disposed over a gate dielectric.